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Prof. M. B. Waite contributed a paper on "Changes in the Local Fungus Flora of Champaign, Ill." In the absence of the author, the paper was read by Mr. Scribner.

Prof. W. J. Beal read a paper entitled "Notes on Some Flowering Plants of Michigan."

At the conclusion of the meeting the Club adjourned to meet next year in Toronto, Canada.

Besides the papers read before the Botanical Club, the following botanical papers were read in Section F of the Association: "A Plea for Uniformity in Biological Nomenclature," N. L. Britton; "A Study of *Hydrangea* as to the Objects of Cross-Fertilization," Thos. Meehan; "A Phase of Evolution," E. L. Sturtevant; "Notes on the Inflorescence of *Callitriche*," Jos. Schrenk; "Hygroscopic Movements in the Cone-Scales of *Abietineæ*," A. N. Prentiss; "Some New Facts in the Life-History of *Yucca* and the *Yucca* Moth," Thos. Meehan; "On the Cause and Significance of Dichogamy in Flowers," Thos. Meehan; "Adaptation in the Honeysuckle and Insect Visitors," Thos. Meehan; "Comparison of the Flora of Eastern and Western Michigan in the latitude of 44° 40'," W. J. Beal; "Observations on the Succession of Forests in Northern Michigan," W. J. Beal; "The Systematic Position of the *Rhizocarpeæ*,"\* Douglas H. Campbell; "Pollen Germination and Pollen Measurements," Byron D. Halsted.

The following botanical papers were read before the Society for the Promotion of Agricultural Science: "Peculiarities of the Plants of Northern Michigan," W. J. Beal; "Notes on the Flowering Plants of Ohio," W. R. Lazenby; "Potato Flowers and Fruit," Byron D. Halstead; "Tomato Flowers and Fruit," Byron D. Halstead; "A Further Study of the Dandelion," E. L. Sturtevant; "Successful Treatment of Black Rot," F. L. Scribner.

DOUGLAS H. CAMPBELL.

### The Systematic Position of the *Rhizocarpeæ*.†

As is well known to botanists, the *Rhizocarpeæ* are distinguished from the other *Filicineæ* in having spores of two kinds,

\* See this BULLETIN, p. 258.

† Read before Section F, at the Cleveland meeting of the A. A. A. S., 1888.

and although the two families constituting the order differ widely in other particulars, this fact has been regarded as of sufficient importance to warrant their union into a special order.

During the past two years the author has had occasion to examine more or less minutely the life-history of several forms, and the results reached do not support the present view. The investigations were made for the most part on *Pilularia globulifera*, L., and *Marsilia Ægyptiaca*. These two plants have been made the subjects of especial papers which will shortly appear, and in which the development of the prothallium, and in *Pilularia* of the sporophyte as well, is discussed in detail, so that no attempt will be made here to give more than a résumé of the results of the investigations. *Salvinia natans*, L. was also examined with some care.

The resemblances between the *Marsiliaceæ* and the true ferns, especially the *Polypodiaceæ*, has been long recognized, but the reduction of the prothallium, particularly the male prothallium, was supposed to be much greater than is really the case.

The *Salviniaceæ*, on the other hand, differ widely both from the *Polypodiaceæ* and also from the *Marsiliaceæ*.

Before stating the conclusions reached it will be well, perhaps, to glance hastily at the development of the different members of the order as far as our knowledge at the present time extends.

#### MARSILIACEÆ.\*

In this order are comprised the two genera *Marsilia* and *Pilularia*, differing mainly in the leaves and fruits, and also in some minor particulars, but on the whole showing very close affinities.

The spores germinate with extraordinary rapidity, especially in *Marsilia*, where in the case of *M. Ægyptiaca*, at least, within thirteen hours from the time the dry spores (in some cases twelve years old!) are placed in water, at a temperature of about 20° C.

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\*Hanstein, "Befruchtung und Entwicklung der Gattung Marsilia," Pringsheim's Jahrb., iv., 197. Hofmeister, "The Higher Cryptogamia," Ray Society, 1862, pp. 318-327. Hanstein, "Pilulariæ globulifere generatio cum Marsilia comparata," Bonn, 1866. Russow, "Vergleichende Untersuchungen." Archangeli, "Sulla Pilularia globulifera e Salvinia natans," Nuovo Giornale Botanico Italiano, viii., 320.

not only are the sexual organs mature, but fecundation has been effected and the first division of the embryo completed.

As was the case with pretty much all of the higher cryptogams, Hofmeister was the first to make extended observations in regard to the life-history of this group; but as was generally the case, while his investigations were in some particulars correct enough, the details were often very erroneous, owing largely, no doubt, to imperfect methods.

Hanstein\* studied in detail the development of various species of *Marsilia*, but owing to his method of treating the young prothallia, made very serious mistakes. Through the action of caustic potash, which he employed freely in order to render the prothallia transparent, the young cell-walls are so much swollen and dissolved as to be practically invisible, and this led him to believe that the female prothallium was at first composed of primordial cells which later became surrounded with membranes, and that the contents of the microspore divided at once into thirty-two primordial cells, the mother-cells of the spermatozoids.

Archangeli,† some ten years later, made *Pilularia* the subject of special study and found that the cell-division in the female prothallium was effected by means of walls, and also demonstrated the presence of a vegetative cell in the male prothallium. The latter fact was also established by Sadebeck‡ for *Marsilia*.

By means of more improved microscopic methods it is possible to obtain thin sections of the youngest stages of the female prothallium of both *Pilularia* and *Marsilia*, and these show an almost identical structure. The plasma of the upper part of the spore becomes cut off by a transverse septum from the cavity of the spore, and from this upper cell is produced by repeated division a single archegonium, all the divisions being effected by cell-walls. The archegonium is of the same type as in other pteridophytes, but has a very short neck, especially in *Marsilia*.

The microspores divide first into two cells, a small basal cell, (the vegetative part of the prothallium) and a much larger one, the mother-cell of the antheridium. The basal cell in *Pilularia* often divides again into two cells of unequal size. The antheri-

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\* l. c.      † l. c.

‡ Schenck's Handbuch.

dium mother-cell divides by a series of walls forming an antheridium which in structure is almost identical with that of the *Polypodiaceæ*.\* As the vegetative part of the male prothallia of certain *Polypodiaceæ* may be almost as much reduced as in *Pilularia*, the resemblance between such a reduced fern prothallium and that of *Pilularia* is too obvious to be overlooked. Add to these the resemblance in the sporophyte, particularly the similarity in the sporangia and the peculiar coiled vernation of the leaves, and the conclusion seems justified that the *Polypodiaceæ* and *Marsiliaceæ* are branches, not very widely removed, of a common stock.

#### SALVINIACEÆ.†

The *Salviniaceæ* differ entirely in habit from the other pteridophytes, being small floating plants which in *Salvinia* are destitute of roots. It is only in regard to their forming two kinds of spores that they resemble the *Marsiliaceæ*, the sporangia and prothallia, as well as the habit of the sporophyte, differing much more widely from the latter than do the *Marsiliaceæ* from the true ferns.

Our knowledge of the prothallia of the *Salviniaceæ* is based mainly on Pringsheim's‡ work, but it is quite likely that his and Juranyi's statement that the young female prothallium is composed of primordial cells, will be found incorrect, as it seems much more in accordance with our present knowledge of cell-division that the process is similar to that in the *Marsiliaceæ*. A striking difference between the latter group and the *Salviniaceæ* is that the *Marsiliaceæ* never produce more than one archegonium, whereas the *Salviniaceæ* invariably produce several.

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\*Kny, "Über den Bau und Entwicklung des Farn Antheridiums," Monatsber. d. Berliner Acad., 1869. Campbell, "The Antheridium of Ferns," BULLETIN TORREY CLUB, 1886.

†Hofmeister, l. c., pp. 328-335. Pringsheim, "Zur Morphologie der *Salvinia natans*," Jahrb. f. Wissensch. Bot., iii., p. 484. Juranyi, "Über die Entwicklung der Sporangien u. Sporen der *Salvinia natans*," Berlin, 1873. Strasburger, "Ueber *Azolla*," Jena, 1873. Berggren, "*Azolla*," Botaniska Notiser, 1876. Archangeli, l. c. (See Luerssen-Handbuch, vol. I, p. 599.) Campbell, "Zur Entwicklungsgeschichte den Spermatozoiden," Ber. d. Deutschen Bot. Gesellsch, April, 1887.

‡l. c.

The only reference I can find upon the development of the prothallium of *Azolla* is an article of Berggren's,\* the original of which I have not seen. From a reference to this in Luerksen's Handbook of Systematic Botany,† it appears that Berggren finds the young female prothallium to be composed of primordial cells. Nothing is said about the male prothallium.

In the article on the development of spermatozoids‡ the author had occasion to describe the male prothallium and antheridium of *Salvinia natans*. The prothallium consists of a relatively large basal cell and an antheridium which differs widely in structure from those of the *Marsiliaceæ*, especially in the small number of spermatozoids, only eight being developed from each microspore.

Where we are to look for the nearest living allies of the *Salviniaceæ* is at present difficult to say, and the matter must remain in doubt until their own life-history, as well as that of certain isosporous *Filicineæ*, is more thoroughly understood.

#### CONCLUSION.

The conclusions reached from a study of the facts here presented are the following: That in the *Rhizocarpeæ* are included two groups which represent the last terms of two distinct series of forms. Of these the *Marsiliaceæ* are in all probability derived from forms closely related to living *Polypodiaceæ*. The exact position of the *Salviniaceæ* must remain for the present in doubt, but they certainly should be removed from their present close proximity to the *Marsiliaceæ*.

DOUGLAS H. CAMPBELL.

#### Onondaga Indian Names of Plants.§

To find appropriate names for plants or other things, shows a sense of fitness, a power of brief description, not very common. An Indian friend suggested giving me not only some Indian names but their meanings, and a portion of the result is embodied

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\* Berggren. "Forengaende meddelande om utvecklingen af prothalliet och embryot hos *Azolla*," Botaniska Notiser, 1876, p. 177.

† l. c.      ‡ l. c.

§ Read before the meeting of the Botanical Club of the A. A. A. S., at Cleveland, Ohio, August 16th, 1888.